

**Acoustic Investigation of RP English
of Long Vowels Formants
Produced by Iraqi EFL Learners**

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Abstract:

Previous male Received Pronunciation “RP” “formant frequencies” of the five long vowels revealed significant differences as far as the acoustic numerical average values. Thirty male students from college of Education for Humanities, University of Mosul took part in the research sessions, pronouncing the same stimuli having the structure (h V_{long vowel} d). This research aims to give an overall view of Iraqi EFL learners of Mosuli origins concerning the production of the RP English long vowel formants; (F1., F2. and F3.). Results of this research give the full description of the all-participants numerical values concerning F1., F2. and F3. of the long vowels. Besides, Iraqi EFL learners produce the vowels /i:/, /ɔ:/ and /u:/ higher and lower for /ɑ:/ and /ɜ:/. And, they tend to make /i:/, /u:/ and /ɜ:/ less back, /ɔ:/ more back and equaled for /ɑ:/. Finally, tend to make /i:/ and /ɜ:/ less rounded, /u:/ and /ɑ:/ more rounded and equaled lips rounding for /ɔ:/, compared to previous production of RP formant vowels related to previous studies.

المستخلص

كشفت ترددات النطق المستلمة السابقة لحروف العلة الطويلة الخمسة الانكليزية للذكور عن اختلافات كبيرة فيما يتعلق بالقيم العددية المتوسطة الصوتية. شارك في جلسات البحث ثلاثون طالباً من كلية التربية للعلوم الإنسانية جامعة الموصل، حيث قاموا بنطق نفس الكلمات ذات التركيب (h V_{الطويلة} d). يهدف هذا البحث إلى إعطاء نظرة شاملة لمتعلمي اللغة الانكليزية كلغة أجنبية من أصول موصلية فيما يتعلق بإنتاج حروف العلة الطويلة الانكليزية فيما يخص الترددات الصوتية (F1, F2, F3). اعطت نتائج هذا البحث وصفا كاملا للقيم العددية (F1.,F2.,F3.) لجميع المشاركين فيما يتعلق بالحروف العلة الطويلة الانكليزية. علاوة عن ذلك، فإن متعلمي اللغة الانكليزية كلغة أجنبية يلفظون حروف العلة /u:/ و /ɔ:/ و /i:/ أعلى و /ɑ:/ و /ɜ:/ ادنى ويميلون إلى جعل /i:/ و /u:/ أقل للخلف، /ɔ:/ أكثر للخلف و /ɑ:/ مساوياً وأخيراً، يميلون إلى جعل /i:/ و /ɜ:/ أقل

تدويرا و /u:/ و /ɑ:/ أكثر تدويرا ومساويا في تدوير الشفاه لـ /ɔ:/، مقارنة بالإنتاج السابق لأحرف
الغلة الإنكليزية والعائدة لدراسات السابقة

1. Introduction:

1.1 The Classification of the Vowels:

The long vowels, to some extents are said to be difficult as far as its pronunciation is concerned. The complexity lies in the sense that it is difficult to feel the position of the tongue in producing them since the articulators (passive and active) do not come very close together, and the passage of the airstream is unobstructed (Roach, 2009; Ladefoged and Johnson, 2015). Hence, vowel sounds are described in terms of the position of the highest point of the tongue, front -back of the tongue and lips rounding (O'Connor, 1980; Ladefoged and Johnson, 2015). Accordingly, in term of the height of the body of the tongue and the front-back position of the tongue; the long vowels are classified as the following:

-The “front vowel” ; /i:/. The tongue is close to the roof of the mouth for the vowel /i:/ as it is classified as a ‘high front vowel’.

- The “back vowels”; /ɑ:/ and /u:/. In these vowels, the tongue is close to the back surface of the vocal tract. The body of the tongue is highest (near enough to the roof of the mouth) in the vowel in /u:/ as it is classified as a ‘high back vowel’, lowest for the vowel/ɑ:/ as it is called a ‘low back vowel’.

Also, vowels can be classified according to the “lips rounding”; . Hence, “long vowels” such as /i:/, /ɜ:/, are said to be “unrounded”, while /ɑ:/, /u:/, and /ɔ:/ are said to be “rounded”. “Long vowels”, in phonetics are called “tense vowels”; as they need much more muscular effort, slightly higher tongue positions, and longer durations than other vowels (Ladefoged and Johanson, 2015, Leung, et al., 2016).

1.2 The Acoustics of the Long Vowels:

The acoustics of the “long vowels” demands a greater knowledge due to their complex structures. The complexity lies on the fact that the long vowels do not only have pitches but also overtones pitches. The pitch of the vowels depends on the pulses being produced by the vibration of the vocal folds. The pitch is called “fundamental frequency” and it is referred as F0. The “overtone pitches” that depend on the shape of the resonating cavities of the vocal tract which give all the vowels their distinctive quality. These overtones are called the “formants” of the vowels (Fant,1973; Ladefoged, 2006; and Ladefoged and Johnson 2015). Each vowel has three formants; “three overtone pitches” In other words, we can say that there are three main aspects of vowels qualities: (a) “vowel height”; “the first formant F1”; (b) “backness”; the “second formant F2” and (c) “the degree of lips rounding”; “the third formants F3” (Hall 2007;Ladefoged, 2006). In the spectrograms, three dark upwards lines bands are good guide for recognizing formant frequencies (Ladefoged and Johnson, 2015). These bands occur at different frequencies for different long vowels. The figure (1) below shows the three dark bands formants of the vowel /i:/ .

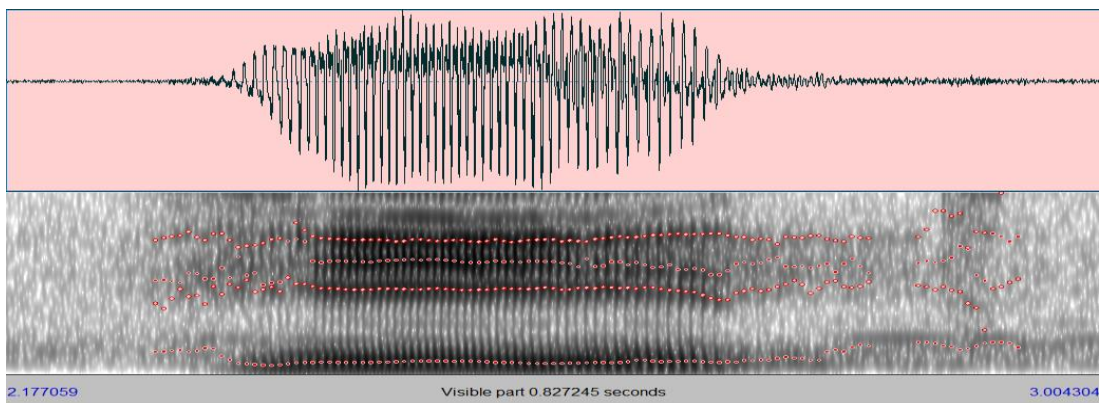


Figure1. The three dark bands of the long vowel /i:/ in ‘heed’

1.3 Statement of the Problem:

English vowels' acoustic waveforms usually include several formants (F1., F2., F3. etc.) with different frequencies. And, in literature, there are limited studies of the formant frequencies of the long vowels related to Iraqi Mosuli EFL learners. Hence, this research will present an acoustic description of "formant frequencies" of F1., F2. and F3. for each five long vowels, to give accurate values of English long vowels related to Iraqi EFL learners. By comparing EFL learner's formant frequencies of F1., F2. and F3. values to the values of previous RP English studies to see the amount of convergence or divergence of both values. Hence, we add to the literature certain acoustic values related specifically to Mousli Iraqi male participants

1.4 Hypothesis:

Since there are certain variation in the results of the British English RP formants frequencies of the previous studies mentioned in this research. Thus, this study will hypothesize that Iraqi EFL learner's formant frequencies of F1., F2. and F3. of the long vowel values that will be different from previous British English "RP" studies as far as formant frequencies of the long vowels is concerned.

1.4 Aims of the Research:

Firstly, this research aims to perform an acoustic analysis to investigate British English (Received Pronunciation RP) formants of the long vowels (quality of the vowels) produced by Iraqi Mosuli EFL male learners specifically pronouncing certain words (the same stimuli of the previous researches) in isolation. Therefore, this research will add to the literature certain numerical averages related to Iraqi Mosuli EFL male learners as far as the production of the formants of the long vowels. Secondly, this research will make certain comparison between the total numerical formants' averages of the "RP" previous studies mentioned in this research and the total averages of the present research to see the differences in formant frequencies whether they are (equal, higher or lower, the deviation as well).

1.5 Procedures and Data Collections:

1. To ensure bias to the effects of age and gender factors on the formants, 30 male students from “English department”, “College of Education for Humanities”, “University of Mosul” are the only participants of this research.

2. The words that are used as data in the present study are monosyllabic words which have the structure CVC (where the first C is ‘h’, V is ‘one of the five long vowels and the final C is ‘d’).

3. Five words with five long vowels in the isolation context are involved in the present research.

Table 1: Words with long vowels and their transcriptions

S.V.	Words	Trans.
/i:/	Heed	/'hi:d/
/ɜ:/	heard	/'hɜ:d/
/ɑ:/	Hard	/'hɑ:d/
/ɔ:/	Hoard	/'hɔ:d/
/u:/	Who'd	/'hu:d/

- List of words is printed on an A4 sheet with their transcriptions with a font size of “100” in order to be readable by all the participants.
- A microphone is connected to Lenovo, Think-Pad personal computer (PC) which is used in all the recordings procedures. The distance from the microphone to the mouth of all participants is about 10 centimeters.
- The speakers have repeated each word 3 times, in which the best one is taken for consideration and the others are dismissed.
- The developed version “Praat”, 2023, with rate 44100 Hz is used to measure and to analyze the words durations and the three formants of the long vowels and saved as wav. files by the nickname of each subject.

8. Formant frequency of vowels has been extracted by “Praat” software automatically. While, vowel region (start and the endpoint) has been identified manually for each word (see figure 2).

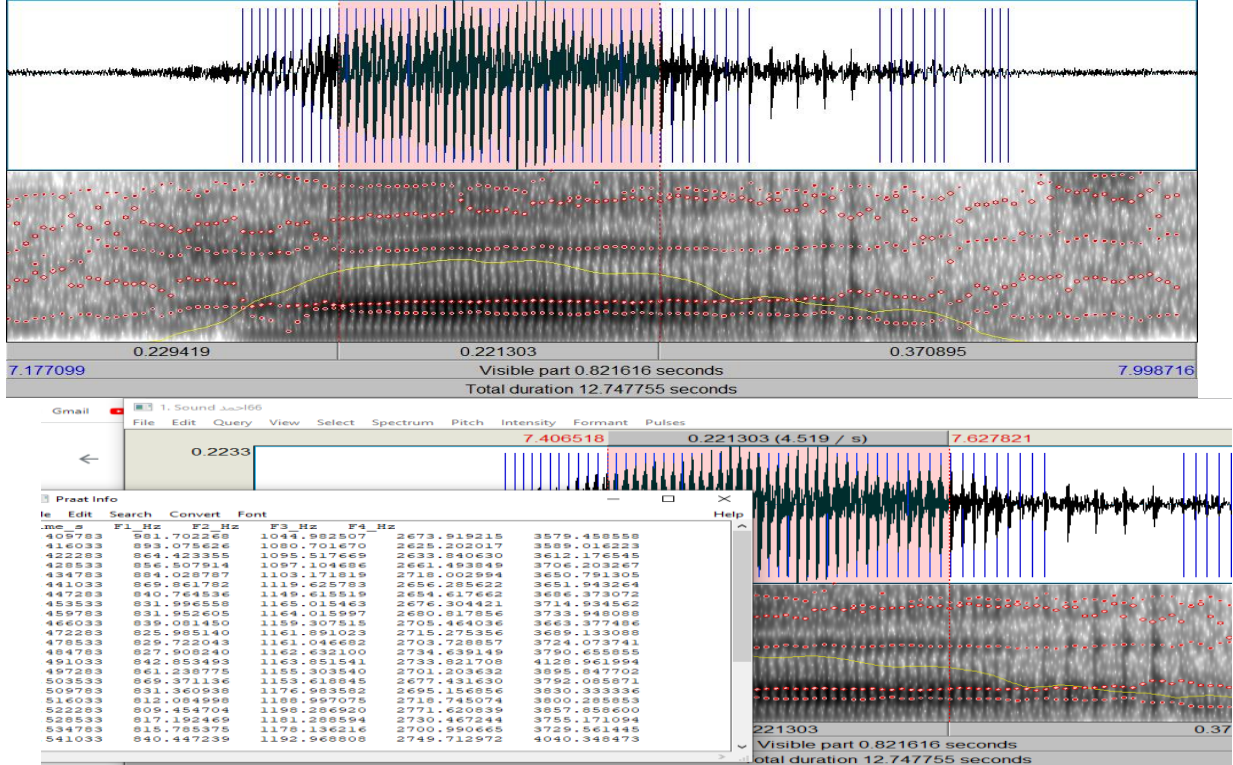


Figure 2: Manual identification of the vowel region and its three formants

9. The Total number of measured tokens is (5 words × 30 participants × 3 formants = 375). All results are measured manually and written in Excel sheets.

2. Theoretical Part

2.1 Previous RP English Studies of Long Vowels Formants:

As for the previous RP English studies, Wells (1960) states certain various frequencies in Hertz related to adult male participants of 21 years old as he shows detailed values of the F1, F2, and F3 of all male participants. Later on, Wells (1962) presents the numerical results of the British English formants of the pure vowels in which twenty-five male speakers read a test of 12 sentences. Fry (1979) in his book “The Physics of Speech” presents certain acoustic measurements of the eleven English RP pure vowels as he states only F1 and F2 of these vowels. Also, Gimson (1980) in his book “Introduction to

the Pronunciation of English” reports values of the frequencies of F1, F2 and F3 of RP English vowels. Henton (1983) detected formant frequencies for eleven British English RP pure vowels spoken by 10 males aged between 25 and 37. The participants used to read a word list twice, having (h v Long vowel d) context. He made a Comparison of RP English male vowel formants “F1, F2 and F3” from data of Wells (1962) and his data. Deterding (1990) states male vowels formants averages used in connected speech (from the MARSEC database). Later on, Deterding (1997) reports the formants of the eleven vowels of Standard Southern British (SSB) pronunciation of English related to five males used in “BBC broadcasters” whose speech was included in the “MARSEC database”. The following table shows the chronological studies that dealt with the English Formants of the long vowels and their total averages.

Table 2: Chronological previous studies and total averages of the vowels’ Formants

Previous studies	Formants number	Heed /i:/	Hard /ɑ:/	Hoard /ɔ:/	Who’d /u:/	Heard /ɜ:/
Wells 1960	1	280	740	480	320	560
	2	2620	1180	760	920	1480
	3	3380	2640	2620	2200	2520
Wells 1962	1	285	677	449	309	581
	2	2373	1083	737	939	1381
	3	3088	2540	2635	2320	2436
Fry 1979	1	300	680	450	300	580
	2	2300	1100	740	940	1380
	3	-----	-----	-----	-----	-----
Gimson 1980	1	280	740	480	320	560
	2	2620	1180	760	920	1480
	3	3380	2640	2620	2200	2520
Henton 1982	1	272	636	429	347	514
	2	2361	1050	697	1149	1417
	3	3056	2540	2441	2300	2497

Deterding 1990	1	275	687	453	302	513
	2	2221	1077	642	1131	1377
	3	-----	-----	-----	-----	-----
Deterding 1997	1	280	740	415	316	475
	2	2249	1180	828	1191	1436
	3	2765	2640	2619	2408	2488
Total Averages of previous Studies	1	282	686	451	316	541
	2	2392	1118	738	1027	1422
	3	3136	2570	2587	2286	2492

3.Results:

3.1 RP Long Vowels Formants Frequencies Total Averages of the Present

Research:

As to the results of this research, Table (3) presents the total averages of the acoustic measurements of “the RP English long vowels formants frequencies in Hertz” related specifically to Iraqi Mosuli male EFL learners which is taken from appendix (1) which presents the formants frequencies of the individual acoustic measurements of the RP English long vowels related to male Iraqi EFL learners.

Table 3: The total averages of the RP English long vowels formants frequencies in Hertz.

Long vowels	Words	F1 (Hz)	F2(Hz)	F3(Hz)
/i:/	Heed	370	2254	2970
/ɑ :/	Hard	673	1123	2671
/ɔ:/	Hoard	563	869	2588
/u:/	Who'd	414	844	2546
/ɜ:/	Heard	520	1426	2445

Accordingly, the formants frequencies (F1., F2. and F3.) in this research are presented as the following: Formants frequencies of the English RP long vowel /i:/ in “heed” are; F1. = 370 (Hz), F2. = 2254(Hz) and F3. = 2970(Hz) respectively. And, the acoustic measurements’ averages of formants frequencies of the long vowel /a:/ in “hard” are; F1. = 673(Hz), F2=1123(Hz)

and F3. = 2671(Hz) respectively. In addition, the Formants frequencies of the long vowel /ɔ:/ in “hoard” are; F1. = 563(Hz), F2. = 869(Hz) and F3. = 2588(Hz) respectively. As to the formants frequencies of the long vowel /u:/ in “who’d” are; F1. = 414 (Hz), F2. = 844 (Hz) and F3. = 2546 (Hz) respectively. Finally, the formants frequencies of the English RP long vowel /ɜ:/ in “heard” are; F1. = 520(Hz), F2. = 1426(Hz) and F3. = 2445(Hz) respectively.

3.2 RP Long Vowels Formants Frequencies Total Averages Differences of the Present Research with Each Previous Studies:

In the following table (4) which presents the variations between the total averages of the acoustic measurements of “the RP English long vowels formants frequencies in Hertz” related specifically to Iraqi Mosuli male EFL learners of the present research and total averages of the acoustic measurements of the RP English long vowels formants frequencies in Hertz related specifically to previous studies mentioned in table (2) in addition to the deviation between them.

Table 4: Formants of the previous studies, the present study and the deviation

F. V.	Resent research	Wells 1960	Dev.	Wells 1962	Dev.	Fry 1979	Dev.	Gimson 1980	Dev.	Henton 1982	Dev.	Deterding 1990	Dev.	Deterding 1997	Dev.
/i:/	370 2254 2970	280 2620 3380	+90 -366 -410	285 2373 3088	+85 -119 -118	300 2300	+70 -46	280 2620 3380	+90 -366 -410	272 2361 3056	+98 -107 -86	275 2221	+95 +33	280 2249 2765	+90 +5 +205
/a:/	673 1123 2671	740 1180 2640	-67 -57 +31	677 1083 2540	-4 +41 +131	680 1100	-7 +23	740 1180 2640	-67 -56 +31	636 1050 2540	+37 +73 +131	687 1077	-14 +46	646 1155 2490	+27 -32 +181
/ɔ:/	563 869 2588	480 760 2620	+83 +109 -32	449 737 2635	+114 +132 -47	450 740	+113 +129	480 760 2620	+83 +109 -32	429 697 2441	+134 +172 +147	453 642	+110 +227	415 828 2619	+148 +41 -31
/u:/	414 844 2546	320 920 2200	+94 -76 +346	309 939 2320	+105 -95 +226	300 940	+114 -96	320 920 2200	+94 -76 +346	347 1149 2300	+67 -305 +246	302 1131	+112 -287	316 1191 2408	+98 -347 +138
/ɜ:/	520 1426 2445	560 1480 2520	-40 -54 -75	581 1381 2436	-61 +45 +9	580 1380	-60 +46	560 1480 2520	-40 -54 -75	514 1417 2497	+6 +9 -52	513 1377	+7 +49	478 1436 2488	+42 -10 -43

Accordingly, and depending on the results mentioned in appendix (1), tables (2,3,4), this research accomplished the following:

As far as the long vowel /i:/, Wells (1960) formants frequencies are: (280, 2620, 3380) Hz. in comparison with the results of the formant's frequencies for the same sound of the present research are: (370, 2254, 2970) Hz. with a deviation approximately; (+90, -366, -410) Hz. And, Wells (1962) formants frequencies are:(285, 2373, 3088) Hz. with a deviation approximately; (+85, -119, -118) Hz. compared to the formant's frequencies for /i:/ related to this research. Fry (1979) formants frequencies are:(300, 2300) Hz. with a deviation; (+70, -46) Hz. compared to the formant's frequencies for /i:/ related to this research. In addition, Gimson (1980) formants frequencies are: (280, 2620, 3380) Hz. with a deviation; (+90, -366, -410) Hz. respectively. As for Henton (1982), the formants frequencies for /i:/ sound are: (272, 2361, 3056) Hz. with a deviation approximately; (+98, -107, -86) Hz.. Deterding (1990) formants frequencies are; (275, 2221) Hz. with a deviation; (+95, +33) Hz. respectively. Finally, Deterding (1997) formants frequencies are; (280, 2249, 2765) Hz. with a deviation (+90, +5, +205) Hz. compared to the results of the formants frequencies of /i:/ sound related to this research. See figure (3), which shows the linear numerical averages variations

of the previous studies and the recent research as far as the formant's frequencies of the long vowel /i:/.

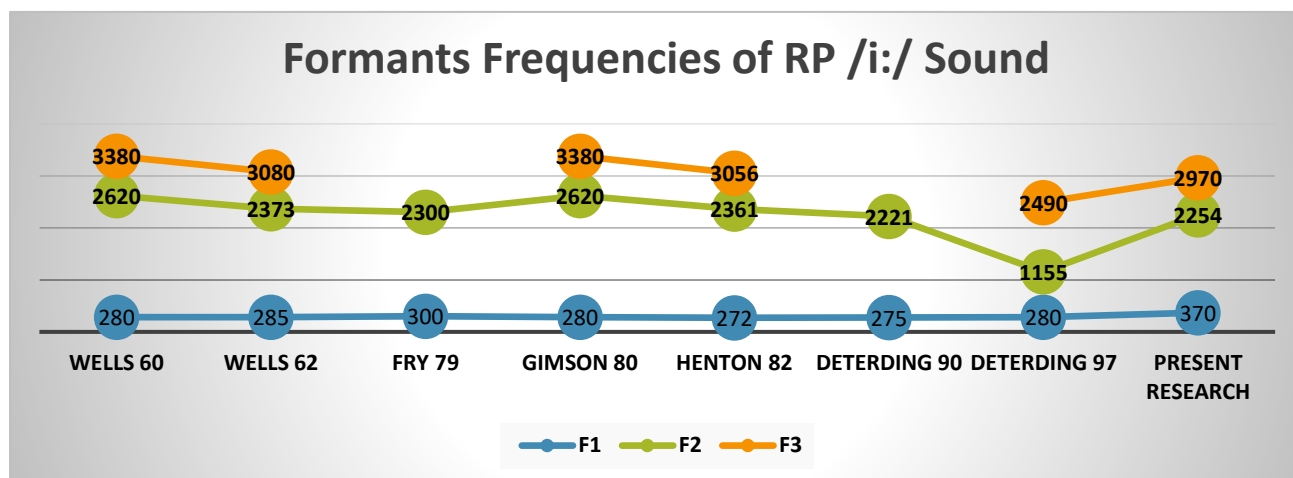


Figure 3 : linear numerical averages variation of formants frequencies of /i:/

As for the long vowel /a:/, Wells (1960) formants frequencies are: (740, 1180, 2640) Hz. in comparison with the results of the formant's frequencies for the same sound of the present research which are: (370, 2254, 2970) Hz. with a deviation approximately; (-67, -57, +31) Hz. And, Wells (1962) formants frequencies are: (677, 1083, 2540) Hz. with a deviation approximately; (-4, +41, +131) Hz. compared to the formant's frequencies for /a:/ related to this research. Fry (1979) formants frequencies; (only F1 and F2) are: (680, 1100) Hz. with a deviation; (-7, +23) Hz. compared to the formant's frequencies (F1 and F2) for /a:/ related to this research. In addition, Gimson (1980) formants frequencies are: (740, 1180, 2640) Hz. with a deviation; (-67, -56, +31) respectively. As for Henton (1982), the formants frequencies for /a:/ sound are: (636, 1056, 2540) Hz. with a deviation approximately; (+37, +73, +131). Deterding (1990) formants frequencies are; (687, 1077) Hz. with a deviation; (-14, +46) Hz. respectively. Finally, Deterding (1997) formants frequencies are; (646, 1155, 2490) Hz. with a deviation (+27, -32, +181) Hz. compared to the results of the formants frequencies of the same sound related to this research. See figure (4) which shows the linear numerical averages

variations of the previous studies and the recent research as far as the formant's frequencies of the long vowel /ɑ:/.

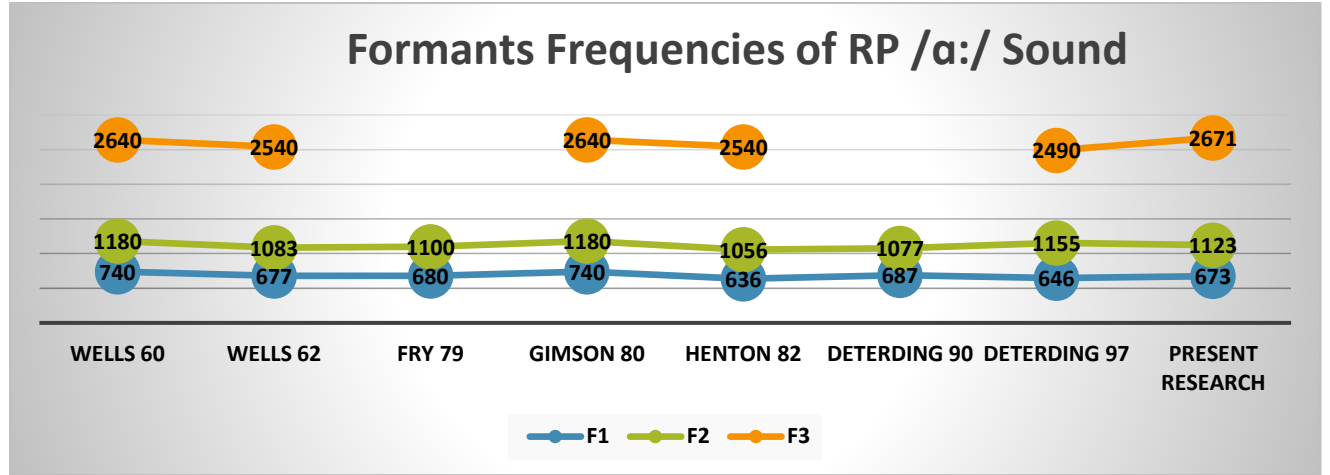


Figure 4: linear numerical averages variation of formants frequencies of /ɑ:/

The long vowel /ɑ:/, Wells (1960) formants frequencies are: (480, 760, 2620) Hz. in comparison with the results of the formant's frequencies for the same sound of the recent research are: (563, 869, 2588) Hz. with a deviation approximately; (+83, +108, -32) Hz. And, Wells (1962) formants frequencies are: (449, 737, 2620) Hz. with a deviation approximately; (+114, +132, -47) Hz. compared to the formant's frequencies for related to this research. Fry (1979) formants frequencies; (only F1 and F2) are: (450, 740) Hz. with a deviation; /ɑ:/ (+113, +129) Hz. compared to the formant's frequencies (F1 and F2) for /ɑ:/ related to this research. In addition, Gimson (1980) formants frequencies are: (480, 760, 2620) Hz. with a deviation; (+83, +109, -32) respectively. As for Henton (1982), the formants frequencies for /ɑ:/ sound are: (429, 697, 2441) Hz. with a deviation approximately; (+134, +172, +147) Hz.. Deterding (1990) formants frequencies are; (453, 642) Hz. with a deviation; (+110, +227) Hz. respectively. Finally, Deterding (1997) formants frequencies are; (415, 828, 2619) Hz. with a deviation (+148, +41, -31) Hz. compared to the results of the formants frequencies of the same sound related to this research. See figure (5) which shows the linear numerical averages

variations of the previous studies and the recent research as far as the formant's frequencies of the long vowel /ɔ:/.

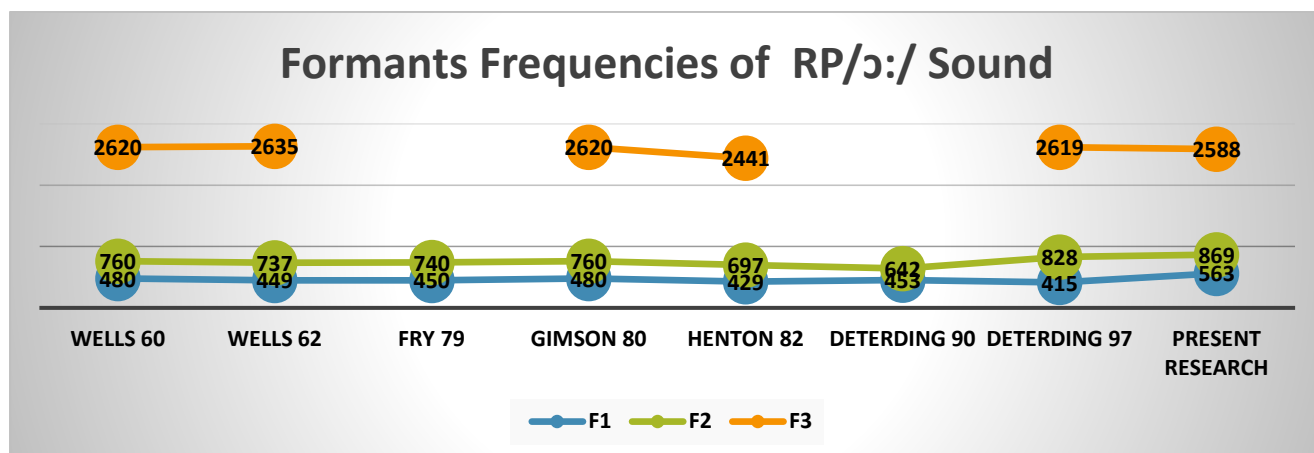


Figure 5 : linear numerical averages variation of formants frequencies of /ɔ:/

As for the long vowel /u:/, Wells (1960) formants frequencies are: (320, 920, 2200) Hz. in comparison with the results of the formant's frequencies for the same sound of the recent research are: (414, 844, 2546) Hz. with a deviation approximately; (+94, -76, +346) Hz. And, Wells (1962) formants frequencies are: (309, 939, 2320) Hz. with a deviation approximately; (+105, -95, +226) Hz. compared to the formant's frequencies for related to this research. Fry (1979) formants frequencies; (only F1 and F2) are: (300, 940) Hz. with a deviation; /u:/ (+114, -96) Hz. compared to the formant's frequencies (F1 and F2) for /u:/ related to this research. In addition, Gimson (1980) formants frequencies are: (320, 920, 2200) Hz. with a deviation; (+94, -76, +346) respectively. As for Henton (1982), the formants frequencies for /a:/ sound are: (347, 1149, 2300) Hz. with a deviation approximately; (+67, -305, 246) Hz. Deterding (1990) formants frequencies are; (302, 1131) Hz. with a deviation; (+112, -287) Hz. respectively. Finally, Deterding (1997) formants frequencies are; (316, 1191, 2408) Hz. with a deviation (+98, -347, +138) Hz. compared to the results of the formants frequencies of the same sound related to this research See figure (6) which shows the linear numerical

averages variations of the previous studies and the present research as far as the formant's frequencies of the long vowel /u:/ in hertz.

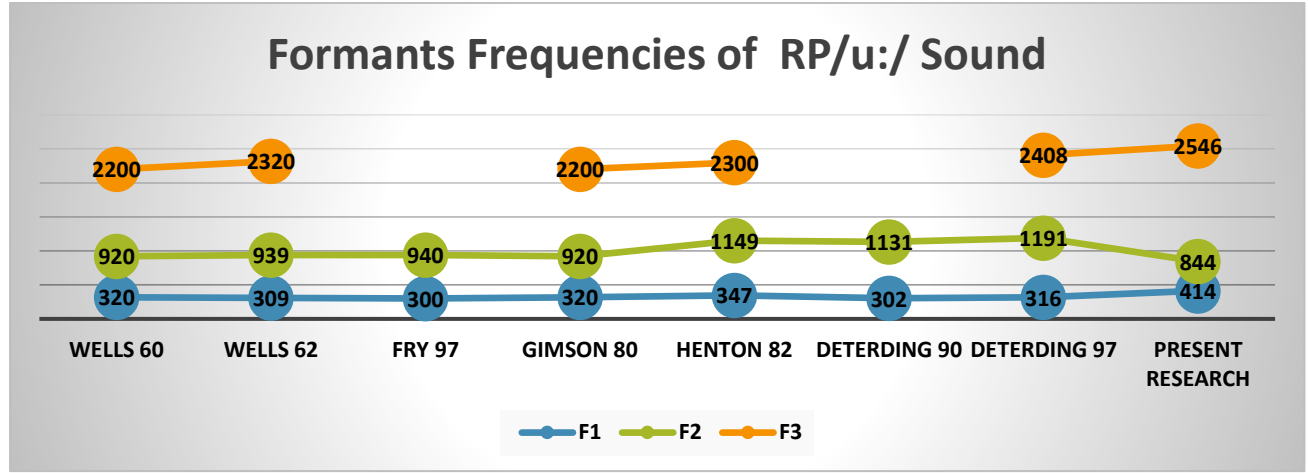


Figure 6 : linear numerical averages variation of formants frequencies of /u:/

Finally, the long vowel /ɜ:/, Wells (1960) formants frequencies are: (560, 1480, 2520) Hz. in comparison with the results of the formant's frequencies for the same sound of the recent research are: (520, 1426, 2445) Hz. with a deviation approximately; (-40, -54, -75) Hz. And, Wells (1962) formants frequencies are: (581, 1381, 2436) Hz. with a deviation approximately; (-61, +45, +9) Hz. compared to the formant's frequencies for related to this research. Fry (1979) formants frequencies; (only F1 and F2) are: (580, 1380) Hz. with a deviation; /ɜ:/ (-60, +46) Hz. compared to the formant's frequencies (F1 and F2) for /ɜ:/ related to this research. In addition, Gimson (1980) formants frequencies are: (560, 1480, 2520) Hz. with a deviation; (-40, -54, -75) Hz. respectively. As for Henton (1982), the formants frequencies for /ɜ:/ sound are: (514, 1417, 2497) Hz. with a deviation approximately; (+6, +9, -52) Hz. Finally, Deterding (1990) formants frequencies are; (513, 1377) Hz. with a deviation; (+7, +49) Hz. respectively. Finally, Deterding (1997) formants frequencies are; (478, 1436, 2488) Hz. with a deviation (+42, -10, -43) Hz. compared to the results of the formants frequencies of the same sound related to this research. See figure (7) which shows the linear numerical

averages variations of the previous studies and the recent research as far as the formant's frequencies of the long vowel /ɜ:/.

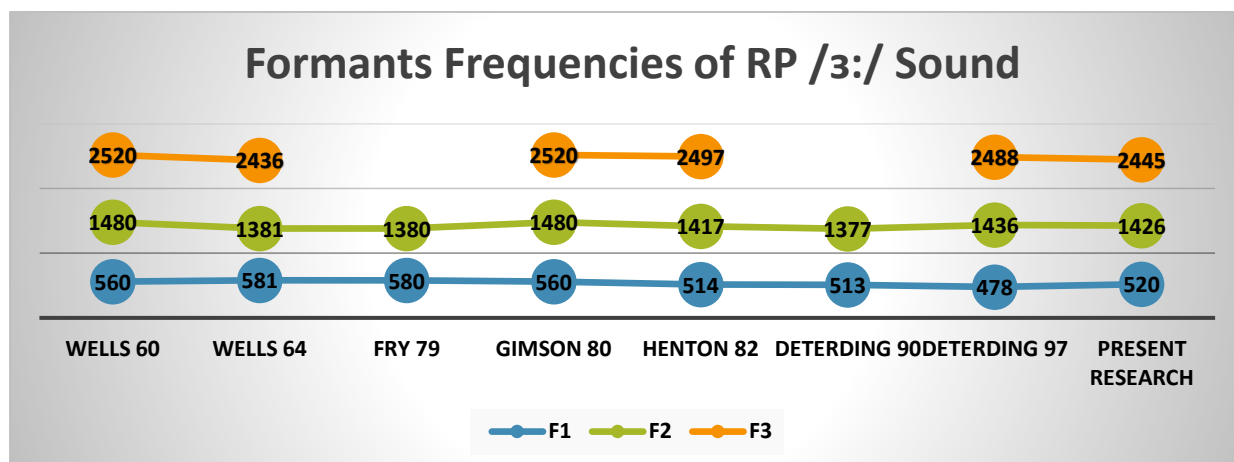


Figure 7: linear numerical averages variation of formants frequencies of /ɜ:/

3.3 RP Long Vowels Formants Frequencies Average Differences of the Present Research with Total Average of the Previous Studies:

For the vowel /i:/, the present average of F1 for this vowel is (370) Hz. which is higher than the estimated F1 total average related to previous studies which is; (282) Hz. The present average of F2 for the same vowel is (2254) Hz. which is lower than the previous estimated F2 total average which is; (2392) Hz. The present averages of F3 for the same vowel is (2970) Hz. which is lower than the previous estimated F3 total average which is; (3136) Hz. related to previous studies (see table 3 and figure 3).

For the vowel /ɑ:/, the present average of F1 for this vowel is (673) Hz. which is lower than the estimated F1 total average of previous studies which is (686) Hz. The present average of F2 for the same vowel is (1123) Hz. which is to somehow equal to the previous estimated F2 total average of previous studies which is (1118) Hz. The present averages of F3 for the same vowel is (2671) Hz. which is higher than the previous estimated F3 total average which is (2570) Hz. (see table 3 and figure 4)

For the vowel /ɔ:/, the present average of F1 for this vowel is (563) Hz. which is higher than the previous estimated F1 total average related to previous studies which is; (451) Hz. The present average of F2 for the same vowel is 869 Hz. which is higher than the previous estimated F2 average ranges which are; (738) Hz. The present averages of F3 for the same vowel is (2588) Hz. which is equal to the previous estimated F3 total average which is (2587) Hz. related to previous studies. (see table 3 and figure 5).

For the vowel /u:/, the present average of F1 for this vowel is 414 Hz. which is higher than the previous estimated F1 total average related to previous studies which is (316) Hz. The present average of F2 for the same vowel is (844) Hz. which is lower than the previous estimated F2 total average which is (1027) Hz. The present averages of F3 for the same vowel is (2546) Hz. which is higher than the previous estimated F3 total average which is (2286) Hz. related to previous studies.(see table 3 and figure 6)

For the vowel /ɜ:/, the present average of F1 for this vowel is (520) Hz. which is less low than the estimated F1 total average related to previous studies which is; (541) Hz. The present average of F2 for the same vowel is (1246) Hz. which is lower than the previous estimated F2 total average which is; (1422) Hz. The present averages of F3 for the same vowel is (2445) Hz. which is lower than the previous estimated F3 total average which is; (2492) Hz. related to previous studies (see table 3 and figure 7).

4.Discussion:

4.1 A Description of RP Formant Frequencies Averages of Iraqi Mosuli Participants

Depending on the previous RP formant frequencies averages related to the previous studies mentioned in table (), and the total formants frequencies averages of the same previous studies mentioned in table (). This research gives a description of RP Formant Frequencies Averages of Iraqi Mosuli Participants and as the following:

For vowel /i:/, Iraqi Mosuli Participants tend to produce this sound higher than other participants of previous English studies since the present F1 is higher than F1 of the previous studies. In addition, Iraqi Mosuli Participants tend to make this sound less back than the other participants of previous English studies since the present F2 is lower than F2 of the previous studies. Finally, Iraqi Mosuli Participants tend to make /i:/ sound less rounded since the present F3 is lower than F3 of previous studies (seetable andfigure).

For the vowel /ɑ:/, Iraqi Mosuli Participants tend to make this sound lower than other participants of previous English studies since the present F1 is lower than F1 of the previous studies. In addition, Iraqi Mosuli Participants produce this sound with the same vowel quality (backness) related to the other participants of previous English studies since the present F2 is somehow equal to F2 of the previous studies. Finally, Iraqi Mosuli Participants tend to make /ɑ:/ sound more rounded since the present F3 is higher than F3 of previous studies (seetable andfigure).

For the vowel /ɔ:/, Iraqi Mosuli Participants tend to make this sound little bit higher than other participants of previous English studies since the present F1 is little bit higher than F1 of the previous studies. In addition, Iraqi Mosuli Participants tend to make this sound more back than the other participants of previous English studies since the present F2 is higher than F2 of the previous studies. Finally, Iraqi Mosuli Participants produce this sound with the same vowel quality (lips rounding) related to the other participants of previous English studies since the present F3 is equal to F3 of previous studies (seetable andfigure).

For the vowel /u:/, Iraqi Mosuli Participants tend to make this sound higher than other participants of previous English studies since the present F1 is higher than F1 of the previous studies. In addition, Iraqi Mosuli Participants tend to make this sound less back than related the other participants of previous English studies since the present F2 is lower than F2 of the previous

studies. Finally, Iraqi Mosuli Participants tend to make this sound more rounded in contrast with other participants of previous English studies since the present F3 is higher than F3 of previous studies (seetable andfigure).

For the vowel /ɜ:/, Iraqi Mosuli Participants tend to make this sound less low than other participants of previous English studies since the present F1 is lower than F1 of the previous studies. In addition, Iraqi Mosuli Participants tend to make this sound less back than related the other participants of previous English studies since the present F2 is lower than F2 of the previous studies. Finally, Iraqi Mosuli Participants tend to make this sound less rounded in contrast with other participants of previous English studies since the present F3 is lower than F3 of previous studies (seetable

4.2 A Comparison Between RP Formant Frequencies Averages of Iraqi Mosuli Participants and Previous studies Averages.

Depending on the numerical Formant frequencies of this research which are related to individual 30 Iraqi Mosuli male participants which are presented in details in the appendix (), RP Formant Frequencies Averages which are presented in table () as well. And, previous RP formant frequencies averages related to the previous studies mentioned in table (). This research gives certain comparison (higher, lower and equaled) of the Iraqi Mosuli EFL male learners as far as the formants of long vowels is concerned in relation to the previous studies and as the following:

F1 for the long vowel /i:/ are higher than the highest F1 of the previous study of Fry 1979 and higher than the lowest F1of the previous study of Henton 1982. F2 for the long vowel /i:/ are lower than the highest F2 of the previous Wells 1962 and Gimson 1980 and lower than the lowest F2of the previous study of Deterding 1990. F3 for the long vowel /i:/ are lower than the highest F3 of the previous study of Wells 1980 and Gimson 1980 and lower than the lowest F3 of the previous study of Deterding 1997. As for somehow equaled numerical formants frequencies, F2 of the long vowel /i:/ is equaled

to Deterding 1997 (see table) . In other words, the present average of F1 for the vowel /i:/ is 370 Hz. which is higher than previous averages ranges (272-280) Hz. The average of F2 for the same vowel is 2254 Hz. which is in between the previous ranges (2221-2620) Hz. And, F3 for the same vowel is 2970 Hz. which is higher than the previous ranges (2221-2620) Hz.

F1 for the long vowel /ɑ:/ are lower than the highest F1 of the previous study of Wells 1960 and Gimson 1980 and higher than the lowest F1 of the previous study of Henton 1982. F2 for the long vowel /ɑ:/ are lower than the highest F2 of the previous study of Wells 1960 and Gimson 1980 and lower than the lowest F2 of the previous study of Henton 1982. F3 for the long vowel /ɑ:/ are higher than the highest F3 of the previous study of Wells 1960 and Gimson 1980 and higher than the lowest F3 of the previous study of Deterding 1997. As for somehow equaled numerical formants frequencies, F1 of the long vowel /ɑ:/ is equaled to Wells 1962 , Fry 1979 and Deterding 1990 (see table)

F1 for the long vowel /ɔ:/ are higher than the highest F1 of the previous study of Wells 1960 and Gimson 1980 and higher than the lowest F1 of the previous study Deterding 1997. F2 for the long vowel /ɔ:/ are higher than the highest F2 of the previous study of Deterding 1997 and higher than the lowest F2 of the previous study of Deterding 1990. F3 for the long vowel /ɑ:/ are higher than the highest F3 of the previous study of Wells 1960 and Gimson 1980 and higher than the lowest F3 of the previous study of Deterding 1997.

F1 for the long vowel /u:/ are higher than the highest F1 of the previous study of Henton 1982 and higher than the lowest F1 of the previous study Fry 1979. F2 for the long vowel /ɔ:/ are lower than the highest F2 of the previous study of Henton 1982 and lower than the lowest F2 of the previous study of Wells 1960 and Gimson 1980. F3 for the long vowel /ɑ:/ are higher than the

highest F3 of the previous study of Deterding 1997 and higher than the lowest F3 of the previous study of Wells 1960 and Gimson 1980.

Finally, F1 for the long vowel /ɜ:/ are lower than the highest F1 of the previous study of Wells 1962 and higher than the lowest F1 of the previous study of Deterding 1990. F2 for the long vowel /ɜ:/ are lower than the highest F2 of the previous study of Wells 1960 and Gimson 1980 and lower than the lowest F2 of the previous study of Deterding 1990. F3 for the long vowel /ɜ:/ are higher than the highest F3 of the previous study of Wells 1960 and Gimson 1980 and higher than the lowest F3 of the previous study of Wells 1962. As for somehow equaled numerical formants frequencies, F1 of the long vowel /ɜ:/ is equaled to Henton 1982 and Deterding 1990. F2 of the same vowel is somehow equaled to Henton 1982 and Deterding 1997, F3 is also equaled to Wells 1962 (see table)

5. Conclusions

The present research and depending on the brief results and discussions conclude the following:

- F1 which indicates the vowels quality; ‘height’, Iraqi Mosuli participants tend to make the vowels /i:/, /ɔ:/ and /u:/ higher or little bit higher and lower for the vowels /ɑ:/ and /ɜ:/, compared to previous production of RP formant vowels related to previous studies.
- F2 which indicates the vowels quality; ‘back ness’, Iraqi Mosuli participants tend to make the vowels /i:/, /u:/ and /ɜ:/ less back or little bit less back, for the vowel /ɔ:/ more back and equaled for the vowel /ɑ:/, compared to previous production of RP formant vowels related to previous studies.
- F3 which indicates the vowels quality; ‘lips rounding’, Iraqi Mosuli participants tend to make the vowels /i:/ and /ɜ:/ less rounded, for the vowels /u:/ and /ɑ:/ more rounded and equaled lips rounding for the vowel /ɔ:/, compared to previous production of RP formant vowels related to previous studies.

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Subjects	Fs	/hi:d/	/h3:d/	/ha:d/	/ho:d/	/hu:d/
S1	F1	419	759	808	567	436
	F2	2605	1751	1198	953	1071
	F3	3485	2845	2770	2823	2700
S2	F1	333	550	616	518	384
	F2	2401	1421	830	784	920
	F3	3328	2023	2464	2479	2936
S3	F1	367	642	668	489	437
	F2	1451	1309	1012	716	1367
	F3	2603	2525	2686	2799	2352
S4	F1	390	521	730	562	538
	F2	2304	2017	1183	1012	642
	F3	2842	2499	2614	2665	2675
S5	F1	349	553	620	569	409
	F2	2199	1515	909	776	978
	F3	2634	2348	2475	2640	2385
S6	F1	334	519	626	597	542
	F2	2316	1264	1061	724	2132
	F3	3081	2577	2655	2721	2979
S7	F1	360	658	737	464	642
	F2	2421	1501	1374	953	1082
	F3	3195	2561	2514	2511	2480
S8	F1	355	586	677	670	379
	F2	2281	1428	949	823	899
	F3	3125	2642	2745	2637	2415
S9	F1	377	517	707	541	510
	F2	2593	1344	1151	927	1103
	F3	2740	2768	2774	2819	2141
S10	F1	368	529	669	523	425
	F2	2275	1505	992	831	831
	F3	3115	2061	3197	2931	2931
S11	F1	415	506	745	652	410
	F2	2352	1251	1083	1037	794
	F3	2449	2657	2939	3018	2852
S12	F1	429	469	648	509	333
	F2	2536	1406	981	720	706
	F3	3315	2106	2167	2490	2911
S13	F1	409	494	721	585	376
	F2	2142	1482	1045	946	930
	F3	3241	2189	2566	2505	2503
S14	F1	325	767	761	629	372
	F2	2025	1439	1221	972	825
	F3	2373	2855	2832	2664	2443
S15	F1	339	542	691	493	374
	F2	2239	1367	1049	798	754
	F3	2949	2949	2479	2609	2309

S16	F1	400	552	625	546	521
	F2	2267	1528	989	886	1367
	F3	3104	2715	2966	2904	2479
S17	F1	336	464	659	521	365
	F2	2504	1719	1095	926	667
	F3	3447	2708	2633	2544	2932
S18	F1	333	509	560	575	338
	F2	1233	1588	827	932	800
	F3	2667	1669	2765	2972	2310
S19	F1	408	544	651	461	347
	F2	2801	1237	966	716	1148
	F3	3703	1823	2683	2453	2522
S20	F1	386	571	764	589	372
	F2	2108	1620	1230	855	1264
	F3	3032	2416	2891	2711	2045
S21	F1	391	624	555	612	373
	F2	2166	871	1520	696	976
	F3	2629	2431	2366	2587	2420
S22	F1	343	652	546	661	377
	F2	2170	919	1337	785	888
	F3	2870	2759	2666	2625	2476
S23	F1	388	710	683	573	434
	F2	2246	1161	1271	994	749
	F3	2729	2642	2524	2668	2610
S24	F1	332	638	546	614	384
	F2	2349	839	1620	850	984
	F3	3192	2744	2134	3277	2744
S25	F1	462	547	648	538	404
	F2	2023	1525	991	983	1168
	F3	2143	2774	3015	2795	2606
S26	F1	366	566	800	597	372
	F2	2083	1605	1257	893	1310
	F3	2934	2367	2768	2536	2161
S27	F1	335	502	674	546	365
	F2	2455	1643	1119	857	766
	F3	3210	2571	2608	2647	2709
S28	F1	411	620	766	542	392
	F2	2161	1655	1097	934	965
	F3	2981	3014	2643	2552	2663
S29	F1	335	581	655	601	401
	F2	2076	1451	1155	899	1099
	F3	3022	2167	3045	2034	2745
S30	F1	332	606	643	544	402
	F2	2145	1404	1166	899	1100
	F3	2976	2198	2557	2325	2711